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### DECLARATION UNDER 37 C.F.R. §1.131 AND EXHIBITS



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### IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	)
Kenneth W. Aull	) Group Art Unit: 2133
Serial No.: 10/027,607	
Filed: December 19, 2001	) Examiner: Nadia Khoshnoodi
For: Public Key Infrastructure I	) oken Issuance and Binding

### DECLARATION UNDER 37 C.F.R. §1.131

Sir:

We, the undersigned, declare as follows:

- 1. We, Kenneth W. Aull, Thomas C. Kerr, William Freeman and Mark A. Bellmore are the inventors of the invention entitled Public Key Infrastructure Token Issuance and Binding, disclosed and claimed in U.S. Patent Application Scrial No. 10/027,607 (hereinafter to as "the Application"), which was filed on December 19, 2001.
- 2. We conceived the subject matter that is disclosed and claimed in the Application prior to December 20, 2000, while employed for a predecessor-in-interest to the Assignee.

Docket No. NG(MS)7191

Serial No. 10/027,607

- Prior to December 20, 2000, we prepared a written description in the form of a PowerPoint® presentation of various aspects of a PKI architecture, including the subject matter claimed in the Application. The written description was updated on November 9, 2000, presenting evidence that the subject matter was conceived at least prior to November 9, 2000. A copy of this written description is attached hereto as Exhibit A.
- 4. On January 4, 2001, we completed a second written description in the form of a PowerPoint® presentation of various aspects of a PKI architecture, including the subject matter claimed in the Application. A copy of this second written description is attached hereto as Exhibit B.
- 5. On February 19, 2001, we submitted an invention disclosure relating to the application. A redacted copy of the invention disclosure is attached hereto as Exhibit C.
- 6. On April 5, 2001, a letter from Lorna Schott (Patent Administrator for the Assignee) requesting preparation of a patent application was forwarded to Donald E. Stout, Esq. at the law firm of Antonelli, Terry, Stout & Kraus, LLP. The letter included the disclosure for the invention described in the Application under docket number 15-0254. A redacted copy of the letter is attached hereto as Exhibit D.
- 7. On Wednesday, April 11, 2001, Henry M. Zykorie at the law firm of Antonelli, Terry, Stout & Kraus, LLP sent an email to us that included a request of additional information. A copy of the email is attached hereto as Exhibit E.
- 8. On Thursday, May 3, 2001, Thomas C. Kerr sent an email to Henry M. Zykorie that included the information requested in Exhibit E. A copy of the email is attached hereto as Exhibit F.

9. On June 22, 2001, Henry M. Zykorie sent a letter to Loma L. Schott that included a draft of the Application, which was prepared by the law firm of Antonelli, Terry, Stout & Kraus, LLP. A copy of the letter is attached hereto as Exhibit G.

- 10. After a review of the draft of the Application, on October 18, 2001, a letter including a marked up copy of the draft of the Application was sent to Henry M. Zykorie of the law firm Antonelli, Terry, Stout & Krous, LLP. A redacted copy of this letter is attached hereto as Exhibit H.
- 11. On October 26, 2001, another drast of the Application was included in a letter to Loma Schott from Henry M. Zykorie. A copy of this letter is attached hereto as Exhibit I.
- 12. We believe that the Application was filed in the U.S. Patent Office on December 19, 2000.
- 13. We declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

thow sull

Kenneth W. Aull

Date

William E. Freeman

11/7/05

Date

Mark A. Bellmore

Docket No. NG(MS)7191

Serial No. 10/027,607

Thomas C Kerr

10/27/2005

Thomas C. Kerr

Date

### EXHIBIT A

### The Winning Technical Strategi Class 4 PK

Ken Aull 11/9/2000

### A complex Customer set (8) DoD Class 4 PKI

### TRW

### □ Many Oars are in this water

- Sponsor of the project has directed that the players below be nice or lose their money
- Class 4 Program Office
- wassigned out of Program Manager +
- is the customer for the system. They run the Class 3 system, which by direction Class 4 system will be replaced with the
- Common Access Card (CAC) Program
- » Run by the ( a forced marriage with the Class 4 PKI
- **Global Information Grid**
- These people supply the Directory technology for the DoD
- Management Initiative (Key Management Initiative)
- will evaluate the security They see this as funding for their KMI program
- 22 Independent Agencies of the ATV- Have the bulk of the money
- Users Not represented by anyone but the prime integrator

## What is the winning technical strategy?



# □ TRW Enterprise Directory and Security (TEDS)

- Not the solution for the without significant modification
- TEDS depends on Apriori Authoritative sources
- policy defines users post facto
- TEDS depends on a well defined management structure
- Chain-of-Command not well suited to this requirement
- TEDS assumes a reasonable level of paranoia about security
- » Technical evaluation team defines new heights of "what if" paranoia

# ■ What TRW brings is an uncommon concern with

- High Security
- Low Cost
- Strictly enforced processes and procedures
- Replaceable COTS structures
- » Have used both Netscape and E-Certify

## The Local Registration Authority (LRA)

TRW

□ The LRA is the Achilles Heel of PKI

· A Classic LRA costs 1 full head per 2000 users

□ TEDS eliminated the LRA

· The manager became the Face-to-Face agent

is not possible □ Elimination of the LRA in the

. The CAC officer is the LRA - a given

There is no authoritative source for manager

One of the constituents is the CAC program

» Will not look favorably on being eliminated

☐ Many of the 22 agencies ( for example)

Will have their own badges

Need to be incorporated into the process

These are an unfunded liability to the program

## CLASS 4 Operations - an opportunity

TRW

- ☐ Class 4 implies a hardware token
- □ The hardware token opens the opportunity for TRW
- · Keep the CAC operators, but add no PKI overhead
- · Easily add badging operators from 22 Agencies
- Eliminate cost of LRA function to support PKI
- ☐ The TRW primary Golden-Goo-Goo (G³)
- Make the CAC operator a badging operator (as intended)
- CAC operator does no explicit LRA functions
- User visits CAC only for badging functions
- » To obtain the first badge
- » To get a loaner badge for a temporary displacement
- » To get a replacement badge for a lost badge
- » To return a badge during check-out

### TRW

### The TRW CONOPS

## ☐ TRW concept is for an "invisible" LRA

- Functionality is hidden from the badging officer and user
- Badging officer does standard functions
- » Identifies User via paper process
- Checks against "database" of users (e.g. Deers/Rapid for CAC)
- » Checks for existing badge (Class 4 keeps record)
- Creates badge, including picture, fingerprint, and PKI certificate
- Allows user to create a PIN for the badge
- » Signs the badge out to the user (Face-to-Face)
- Cancels any lost badge
- Issues temporary badges, logs and destroys returned badges
- From the view point of the user and the badging officer
- PKI appears to add no additional complexity
- is done, no further action required, ever Common
- No additional labor over issuing a plastic badge as currently done
- » User never revisits the LRA for ANY PKI related reason
- » No labor expended for the support of PKI

### TRW CONOPS

### TRW

# ☐ Simple user visits badging office for a badge

- · User comes away with a badge
- » Picture for humans
- > Digital Signature for computers and documents
- If badge is lost or expires
- Returning to the badge office restores picture and Digital signature
  - » Cancels (revokes) any private key stored on token
- Temporary badge creates a one-day signature
- Does not require canceling the permanent badge or certificate
  - » No flooding of the Certificate Revocation List (CRL)
- Returned badges only require physical destruction of badge
  - > Physical destruction eliminates any chance for use
- Does not require flooding of the Certificate Revocation List (CRL)



### TRW Conops

# ☐ Office worker will require Encryption certificate

- · TRW approach allows remote generation of encryption keys
  - The private key can only be unlocked on the token (G3)
- The identity of the User and Badge is crytologically sound  $(G^3)$
- The function happens on an untrusted workstation (G3)
- » Removes the labor of visiting the badge office
- » Travel, badge officer time, user time are all saved

# ☐ Recovery of Encryption certificate is the same

- User uses token for identification
- User recovers directly the encryption certificate and keys (G³)
  - Keys are never exposed to the untrusted Workstation (G3)

### TRW Conops

### TRW

# ☐ Organizations will require Role Certificates for users

- Roles are created by TRW E-Form Process (G3)
- Roles members are managed by Role Owner identified in Form (G³)
- Process is entirely electronic, and definable by Sponsor (G3)
- Greatly simplifies the day to day management of KMI

## ☐ Users will require Certificates for their roles

- · User can get own role certificates via the Web (G3)
- No LRA is involved, just the token, the Pin and Role (G3)
- » Major savings in travel, LRA time, User time
- Existing private key is RESIGNED into a role Certificate (G3)
- Unique process means its safe on an untrusted workstation (G³)





# ☐ Users will have many, many badges and certificates

- A different badge is required on the
- Only 3.1M users will have CAC, 1M will have something else
- Many users will have a CAC, one or more organizational badges
- Typical user may have four badges
- By the nature of the token, each badge has multiple certificates
  - Personal Identity sponsored by the badge issuer (CAC model)
    - Personal Encryption certificate for primary email
- Personal Encryption certificates for secondary email addresses
- Role certificates for within the organization for signing
- Role certificates for within the organization for encryption for role
- Historical encryption certificates
- Typical badge may have from 1 to 8 certificates

### TRW

### TRW Conops

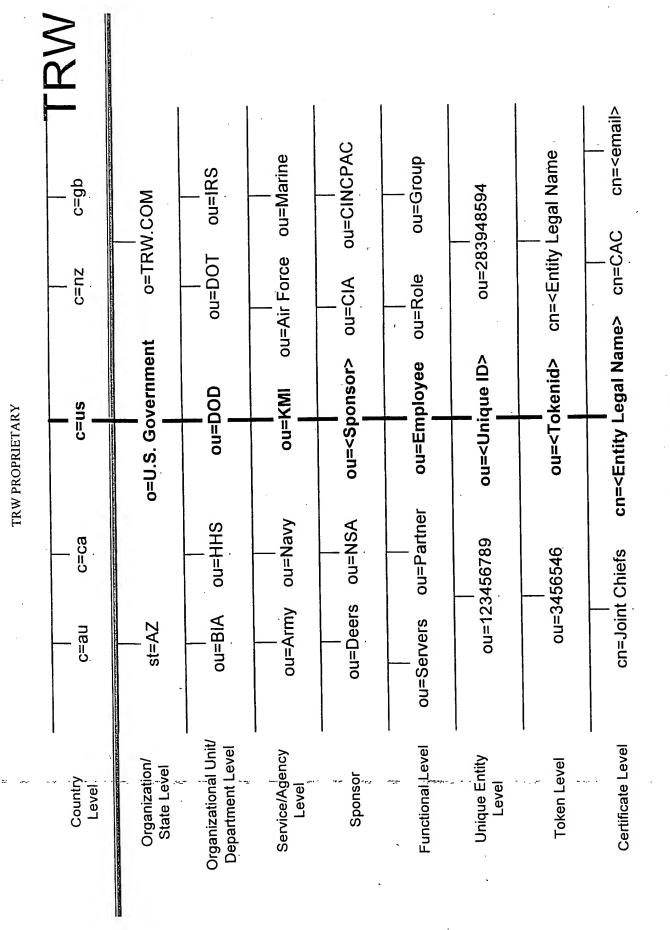
# □ TRW structures the KMI directory for GIG/PKI

- Directory is substructured by sponsor (G3)
- Recognizes a person can have many sponsors (CAC, 22 agencies)
- Directory is substructured by type of sponsored entity (G3)
- Employees, partners, customers, Servers, Roles, Groups
- Directory is substructured by Entity Identity (G3)
  - Each Sponsor supplies unique World Wide ID (WWID)
- Prevents identity theft
- Directory is substructured by Token (G3)
- Recognizes multiple badges per identity
- Provides for temporary badges, prevents badge theft
  - Provides for multiple classification levels
- Directory is substructured by Certificate (G<sup>3</sup>)

Recognizes many certificates/keys per token

- » Allows autorevoke of lost token

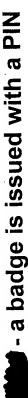
# TRW approaches uses replication for GIG (G3)



TRW PROPRIETARY

### The G<sup>3</sup> Summary - User

## □ From the User Viewpoint - Its just a badge



- » Used to sign things and visit web pages that's all that is needed
- Never visit the badge office unless the badge expires or is lost

### Office Worker - a badge is issued with a PIN

- Used to sign things and visit web pages
- Also used to encrypt files and emails self handled
- Recovery of historical files self handled
- » Never visit the badge office unless the badge expires or is lost

## Organizational Worker - a badge is issued with a PIN

- Used to sign things and visit web pages
- Also used to encrypt files and emails self handled
- Recovery of historical files self handled
- » Issuance and recovery of role keys self handled
- Never visit the badge office unless the badge expires or is lost

## Replace the badge every 3 years, its easy

## The G<sup>3</sup> Summary - 22 Agencies

### TRW

## Each Agency controls its badging system

- Identity totally under the control of the sponsor
- » Identity certificates automatically issued
- Badging under the control of the sponsor
- PKI entities under the control of the sponsor
- » Employees, Partners, Customers, Servers, Roles, Groups
- Agency issues their own tokens
- No additional operational costs at the badging office
- Automated E-Forms system for creation of PKI entities
- » Easily tailored to Agency requirements
- Encryption and Role certificates Self Handled

### ☐ Full Control of their entities

- Minimum Cost to maintain full security
- Minimal disruption and training

The G3 Summary - Am and KMI

### TRW

# □ The The Thigh security underpinning for KMI

- Primary identity key-pair generated at a trusted workstation
- Private identity key is generated on the token itself, never leaves
- Happens invisibly during badge generation
- Full Face-to-Face and ink signature collected as part of badging
- Additional identities, such as roles, are resigns of private key
- » This can be done safely on untrusted workstations
- A major advantage for the next generation KMI
- Encryption certificates are generated at the central facility
- FIPS-140-3 level key generates assure the highest quality keys
- Keys are returned wrapped in the public key of the owner
- Can only be recovered on a specific token, by a specific user
- Fully secured even on an untrusted workstation
- » Key recovery mechanism is fully automated for self recovery

## High Security and Low Cost, a win for KMI

TRW PROPRIETARY

15

### EXHIBIT B

Improving Key Generation & Delivery Smart Cards Processes for

04 January 2001

### TRW Our PKI Background – Pilots (2)

<ul> <li>1000+ X.509 signing certificates issued to employees, servers, roles, customers</li> <li>VPN using Aventail servers</li> <li>Employees authenticate from home using Aventail clients</li> </ul>	<ul> <li>200+ signing certificates for employees, servers</li> <li>Signatures for HTML based forms</li> <li>7 separate pilots for PK enabled applications</li> </ul>
TRW Pilot Sep 99 – Jan 01 Netscape CMS CDC X.500 Directory fed by TRW HR's PeopleSoft database	Apr 00 – Jan 01 E-Certify RA/CA Isode X.500 Directory

## Production PKI Rollout Plans

• 130,000 X.509 dual certificates being VPN using Aventail servers partners CDC X.500 Directory fed by TRW Encapsulated E-Certify RA/CA HR's PeopleSoft database Iaunch

Encapsulated E-Certify RA/CA Microsoft Active Directory VI launch

• 190,000 dual certificates to be issued to employees, servers, roles, partners, Digitally signed JettForms (XML) issued to employees, servers, roles, • ~Class 2, 3, & 4 certificates customers

proprietary HTML based forms • Digitally signed JettForms +

Class 4 only

# Recent Insights, Lessons Learned

- If tokens have a digital identity, great things are possible
- Discrimination between Class 2, 3, 4 certificate stores
- Recognition of TRW versus non-TRW tokens
- Secure, high integrity data path from CMS all the way to the token over any non-secure network, through un-trusted workstation
  - Greatest long term cost savings will come from transition to signed XML forms, automated workflows
- Eliminate most paper forms and people to push them
- First example is reduction of labor for PKI O&M
- Tighter security, accountability, auditability
- Non-repudiation if forms and data signed digitally
- Data integrity if forms serialized, auto-filled, and signed by CMS

- Improve speed, security, & data integrity of key generation and key distribution
- Reduce number of potential points of failure
- Reduce complexity of LRA workload
- Reduce overall life cycle cost
- Eliminate need for trusted LRA workstations
- obtain additional certificates (roles, encryption...) Eliminate need for personnel to re-visit LRA to
- Simplify processes for historical recovery of encryption certificates

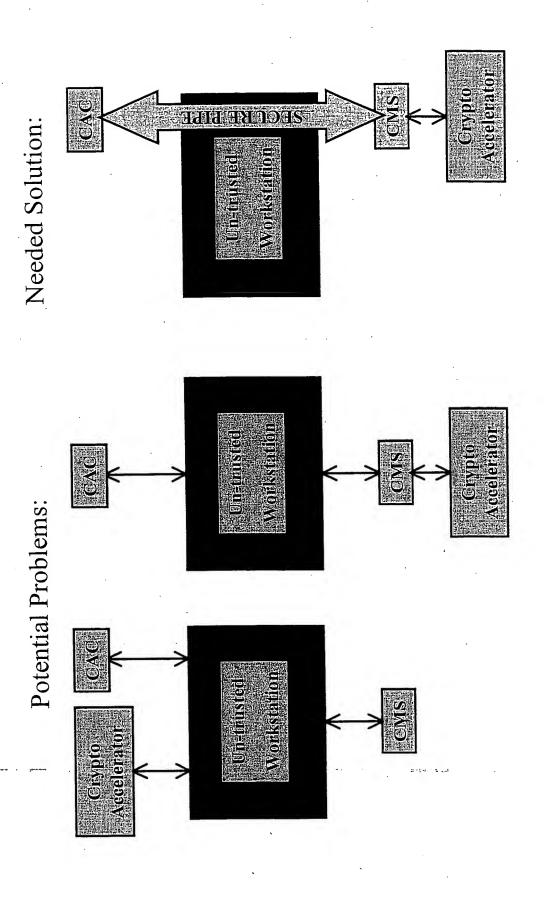
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### Rationale

- trusted communications between workstation & Smart Card Need for trusted LRA workstations driven by need for
- Potentially simple solution:
- Validate existing standards-based way to give each Smart Card a private key for unwrapping encrypted private keys & certificates
- Have CA retain each card's corresponding public key in protected database or directory branch
- Have CA wrap (encrypt) and sign all certificates intended for storage on a Smart Card using that card's public key
- Requires only 2 trusted Smart Card key generation systems world-

# TRW

Potential Problem & Solution

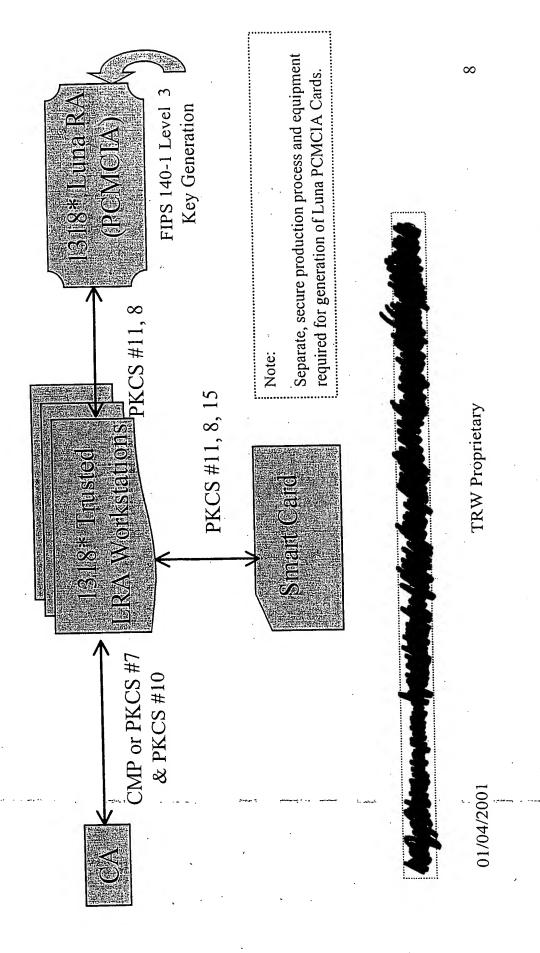


TRW Proprietary

01/04/2001

### TRW

### Technical Approach #1



### Pros/Con for Approach #1

- Faster, more robust key generation
- > Sample costs for RAPIDS based CAC
- o 1318 trusted workstations/environments for LRAs
- o 1318 Chrysalis Luna PCMCIA Cards (~ \$28M)
- o Processes/facility for Luna PCMCIA Card generation
- security link (1318 potential points of compromise) > LRA is still a critical PKI component and weakest
- o Higher skills required than shown by current Class 3 PKI's E-1s and foreign nationals
- ➤ "Non-repudiation" of private key could face legal challenge since not generated on Smart Card

## PKCS #12, Section 3.1, Exchange modes

TRW

There are four combinations of privacy modes and integrity modes. The privacy modes use encryption to protect personal information from exposure, and the integrity modes protect personal information from tampering. Without protection from tampering, an adversary could conceivably substitute invalid information for the user's personal information without the user being aware of the substitution.

The following are the privacy modes:

- using a trusted encryption public key of a known destination platform (see Section • Public-key privacy mode: Personal information is enveloped on the source platform 3.3). The envelope is opened with the corresponding private key.
- Password privacy mode: Personal information is encrypted with a symmetric key derived from a user name and a privacy password, as in [15]. If password integrity mode is used as well, the privacy password and the integrity password may or may not be the same.

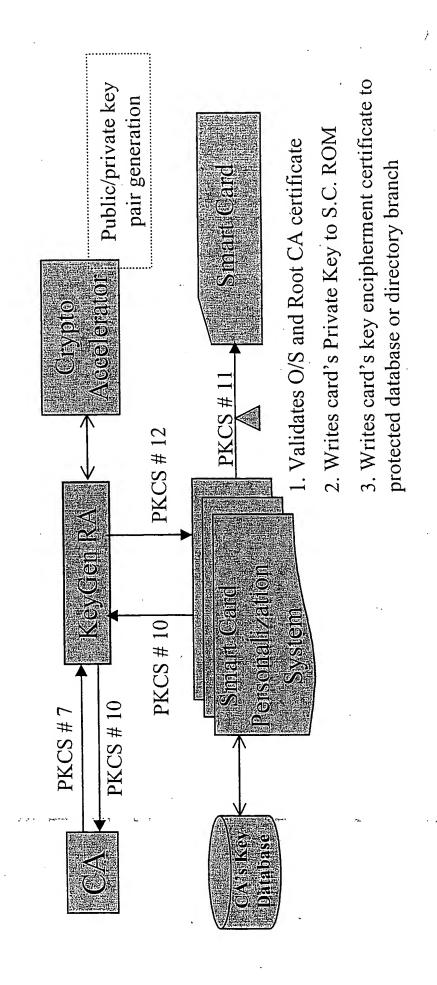
The following are the integrity modes:

signature key. The signature is verified on the destination platform by using the contents of the PFX PDU, which is produced using the source platform's private Public-key integrity mode: Integrity is guaranteed through a digital signature on the corresponding public key (see Section 3.4).

(MAC) derived from a secret integrity password. If password privacy mode is used as well, Password integrity mode: Integrity is guaranteed through a message authentication code the privacy password and the integrity password may or may not be the same.

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### Technical Approach #2



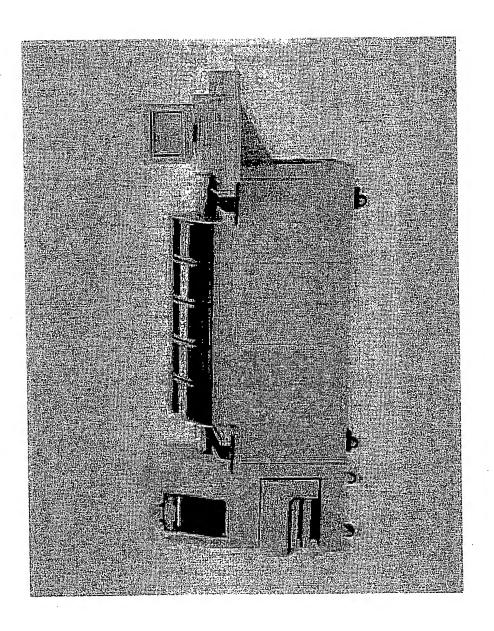
## Technical Points - Approach #2

TRW

- PKI Smart-Card Key Generation System (S-CKGS) would be installed in PKI containment facilities
- S-CKGS validates O/S load and Root CA certificate for Smart Card
- S-CKGS generates unique 1024 bit key pair for each serialized Smart-Card using FIPS 140-1 Level 3 crypto accelerator
- CA signs card's public key into Key Encipherment certificate with OU=<Smart Card serial number>
- Smart Card's certificate (public key) written to protected PKI database (only CA has access to public keys for Smart Cards)
- S-CKGS writes card's private key to Smart Card ROM
- DataCard 9000 can perform this process at 900 cards per hour

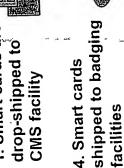
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### DataCard 9000



# CONOPS for Smart Card Based PK

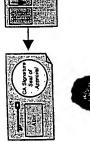
1. Smart cards are drop-shipped to CMS facility





loaded with unique key wrapping keys 2. Smart cards are

badging Facility, 5. User visits credentials presents



3. Secret key for each smart card

is saved

TRW

Officer reviews 6. Badging



credentials



user's organizational filled at CMS from 9. E-Form is auto



database



User - previous badges

are revoked/expired

id, Smart card ID, &

organization code

redundant badge for

8. CMS checks for

7. Badging Officer

signs request for

E-form with user

certificate generated for User, wrapped in Smart 12. Signature key and



validates Badging

review data against

credentials, signs E-Form & submits

10. Badging Officer

11. CMS facility

gets E-Form &

Officer signature

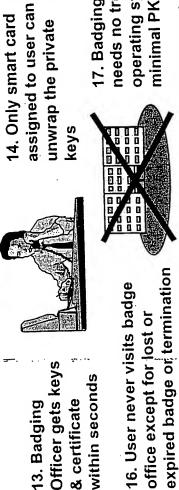
Card's public key 15. User gets



keys & certificates encryption, role at own desk



18. Massive reduction with superior security in operational costs



Officer gets keys

13. Badging

within seconds

& certificate

17. Badging Officer operating system, needs no trusted

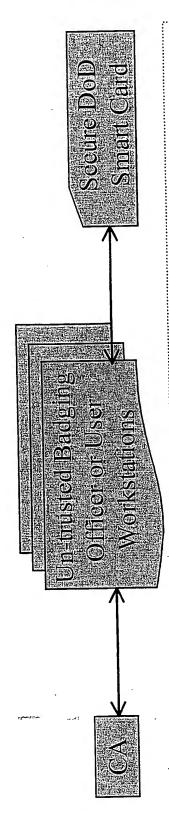
minimal PKI training

FRW Proprietary

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## Subsequent Actions



## Issuing the User's X.509 Signing Certificate:

- Badging Officer uses un-trusted workstation to bind specific Smart Card serial number to specific user ID for that C/S/A.
- CA; wraps user's private key and signing certificate in public key of the specific Smart Card, Integrity Mode of PKCS #12. Private key is marked as non-exportable. User bound to that signs the wrapped package, and sends via Public Key Privacy Mode and Public Key Smart Card ID in CMS.

## All subsequent Role, Group, and Encryption certificates:

- Badging Officer not required; users can securely obtain all other certificates from any untrusted PC or workstation.
- CA, wraps each new certificate using the user's Smart Card's public key and then signs the wrapped certificate.

Badging Officer authenticates to RA/CA server

Badging Officer requests badge issuance form for <User (D>, <C/S/A ID>, and <Smart Card serial number>

CMS retrieves that C/S/A's form, assigns serial number to database or directory, signs the form, logs it to audit trail, form, auto-fills the user's data from the authoritative & issues it to Badging Officer

Badging Officer and user validate data

Badging Officer signs & submits finalized request

01/04/2001

TRW Proprietary

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## Cost / Performance Estimates

- configuration DataCard 9000 can process 900 DataCard engineers estimate that a minimum Smart Cards per hour
  - 7 parallel paths at 28 seconds per Card
- 2 sites can process 1800 cards per hour



### Benefits

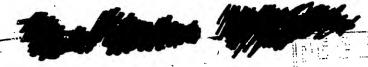
- Eliminates need for Badging Officers to have trusted workstations (\$\$)
  - Fewer points of vulnerability; lower skill levels
- Much faster key pair generation times
- Eliminates need for 1318 remote crypto accelerators to generate key pairs (\$\$)
  - LRA becomes simply a badging person (notary)
- "I swear that I validated J. Doe's credentials and issued badge #130440 to him/her."
- After initial face-to-face, no need for Badging Officer for other certificate requests (\$\$)
  - Smart Cards become integral part of central CMS
- Only CMS can load a certificate on any

### Recommendations

Assess potential impacts to **\*\*\*\*** Smart Card:

- Verify whether support for PKCS #12 is requirement under Smart Card contract(s). If so,
- Require use of Public Key Privacy and Public Key Integrity exchange modes
- Remove support for Password Privacy and Password Integrity exchange modes from CAC S/W
- Note: This prevents a denial of service attack on the Smart Card.
- Assess impact of storing private key on Smart Card
- Verify whether Root CA certificate is already on CAC
- Validate potential for ( cost savings

EXHIBIT C



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2/19/01

	and Dinding Process
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Title of Invention: PKI Token Issua	

### Inventor(S) [See instructions on Website for assistance in determining inventorship]

(Note: to add more inventors, please press the TAB key after the last entry in the last column to insert a new row.)

	(Note: to add more inventors, please	press the	TAB key a	itter the las	TDIM Mail			
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	Full Name (No Initials)	Badge	Division_	3KLB	FP1/4165	J-0020	Bob Lentz	ĺ
	Kenneth Wagner Aull	150135		3KLC	FP1/4165	3-5618	Kathy McLernon	ĺ
	Thomas Carroll Kerr	130440	1	0.125	onsultant			

\*Type (NMI) if you have no middle name. Please note if you are a consultant.

*Type (NMI) if you have no midd	ile name. Please	e note il you e	Zip Code	Home Phone	Social Security Number
Home Address	City	State	22030		
Ken Aull, 5364 Lake	Fairfax	VA	22030		
Normandy Ct Tom Kerr, 5348 Black	Fairfax	VA	22032		
Oak Dr			<del></del>		

(No P.O. Boxes)						
Conception of Invention						
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Date of First Drawings:				Present Location	on:	
Date of First Sketches:		·		<del>-</del>		
Date of Formal Drawings	s, if any:			Present Locati	on:	
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	(Check resid	Yes 🗍	No 🛛	Date:		
Invention Simulated?		100	-	By Whom:		
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wention Successfully sisted?  By Whom:  see Or Offer For Sale (Must be Completed)  (as Invention the Subject of Commercial Activity? Yes  No  Whom:  Sommercial Activity Means External to TRW and Includes Activity with the Government)  Date:  Yes  (A) Date of First Executed Sales Contract:  (B) Identify First Sales Contract No.:  (C) Date Of First Delivery To Customer:  Was invention Described in a  Yes  No  Date:  Proposal?  Was a Description of the Invention  Yes  No  Date:  Provided to the Government?  Was a Description of the Invention  Yes  No  Date:  Provided oas Part of an On-going  Contract?  If you answered YES to any of the above questions, please provide a copy of the material which included the description.  It anticipated that an activity will  Yes  No  Expected Date:  State Invention Flease provide the appropriate information above and enter expected date.  Publication [Publication means printed and distributed outside TRW] (Must be Completed)  Has a Description of the Invention Been Published? Yes  No  Expected Date:  If Yes, Provide Copy and Identify Publication and Date: Powerpoint briefing titled "Improving Key Generation & Customer, Date, and No.  Date:  If The Invention Has Been Described in a Customer Report, Provide Copy and Identify the Customer Report Have a TRW Proprietary Legend?  Yes  No  Date:  If The Invention Been Described to People Not Employed by TRW?  Yes  No  Material Report Provide Not Sand Pr	√W IR&D project		<b>A</b> Date		
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Has a Description of the Invention Been Published? Yes No If Yes, Provide Copy and Identify Publication and Date: Powerpoint briefing titled "Improving Key Generation & Delivery Processes for Smart Cards"  If The Invention Has Been Described in a Customer Report, Provide Copy and Identify the Customer Report by Customer, Date, and No.  Did the Customer Report Have a TRW Proprietary Legend?  Has the Invention Been Described to People Not Employed by TRW?  If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement? Yes  (B) Provide Names of Person(S), Their Employers(S), Date, and Place of Disclosure:  (Obtain All Signatures Before Sending to Patent Counsel)  Inventor: Date: Inventor: Date: Inventor: Date: Inventor: Date:		·			
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If Yes, Provide Copy and Identify Publication and Date: Powerpoint briefing titled "Improving Rey Generation of Delivery Processes for Smart Cards"  If The Invention Has Been Described in a Customer Report, Provide Copy and Identify the Customer Report by Customer, Date, and No.  Did the Customer Report Have a TRW Proprietary Legend?  Has the Invention Been Described to People Not Employed by TRW?  If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement?  (B) Provide Names of Person(S), Their Employers(S), Date; and Place of Disclosure:  (Obtain All Signatures Before Sending to Patent Counsel)  Inventor:  Date: Inventor: Date:	Live - Description of the Invention B	leen Published? Ye	s 🛛 No 🗌		
Delivery Processes for Smart Cards  If The Invention Has Been Described in a Customer Report, Provide Copy and Identify the Customer Report by  Customer, Date, and No.  Did the Customer Report Have a TRW Proprietary Legend?  Has the Invention Been Described to People Not Employed by TRW?  If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement? Yes  (B) Provide Names of Person(S), Their Employers(S), Date, and Place of Disclosure:  (Obtain All Signatures Before Sending to Patent Counsel)  Inventor:  Date: Inventor: Date: Dat	If Ves Provide Conv and Identify F	Publication and Date:	Powerpoint briefin	g titled "Improving Key C	Seneration &
Customer, Date, and No.  Did the Customer Report Have a TRW Proprietary Legend?  Has the Invention Been Described to People Not Employed by TRW?  If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement? Yes  (B) Provide Names of Person(S), Their Employers(S), Date; and Place of Disclosure:  (Obtain All Signatures Before Sending to Patent Counsel)  Inventor:  Date: Inventor: Date: Inventor: Date: Inventor: Date: Inventor: Date: D					
Did the Customer Report Have a TRW Proprietary Legend?  Has the Invention Been Described to People Not Employed by TRW?  If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement? Yes  (B) Provide Names of Person(S), Their Employers(S), Date, and Place of Disclosure:  (Obtain All Signatures Before Sending to Patent Counsel)  Inventor: Date: Inventor: Date: Inventor: Date: Inventor: Date: D	If The Invention Has Been Describe Customer, Date, and No.	ed in a Customer Rep	Juli, Provide Copy (		
Has the Invention Been Described to People Not Employed by TRW?  If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement? Yes  (B) Provide Names of Person(S), Their Employers(S), Date, and Place of Disclosure:  (Obtain All Signatures Before Sending to Patent Counsel)  Inventor: Date: D	Did the Customer Report Have a T	RW Proprietary Lege	end?	Yes 📆	No 🕌
If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement? Yes  (B) Provide Names of Person(S), Their Employers(S), Date, and Place of Disclosure:  (Obtain All Signatures Before Sending to Patent Counsel)  Inventor: Date: Da	Has the Invention Been Described	to People Not Emplo	yed by TRW?	Yes 💮	No 🐙
(Obtain All Signatures Before Sending to Patent Counsel)  Inventor:  Date: Inventor: Date: D	If Yes (A) Was Disclosure Under	r a Confidential Disc	osure Agreement?		
(Obtain All Signatures Before Sending to Patent Counsel)  Inventor: Date: Da	(B) Provide Names of Per	son(S), Their Emplo	yers(S), Date,-and-P	lace of Disclosure:	
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Mitnessed Read and Linderstood by: Witness: Date: Supervisor:		100	Date:	Supervisor:	Date:

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Obtain All Signatur	es belore deficit	g to Patent Counsel)	Date:	Inventor:	Date:
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Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read a	and Understood b	y: Witness:	Date:	Supervisor:	Date:

SYSTEMS125 Rev. 05-99

### Related Printed Publications and Reference Material (Must be Completed) Identify Any Patents, Printed Publications, Written Reports, or Proposals That You Are Aware Of Relating to Closely Analogous Concepts, and Provide Copies: Identify Any Prior TRW Invention Disclosures, Patent Applications, or Issued Patents Relating to the Invention: Ken Aull: Contract or Project Information (Must be Completed) The Invention First Conceived While Charging Time to Job No.: 99X637 And Working On: DoD PKI Marketing (OITE) Title: ☐ Government Contract or Subcontract No.: Title: TRW Funded (IR&D, B&P, PM&P) Project No.: Customer. Commercial Contract No.: Working as TRW Technical Fellow Other, Explanation: Bob Lentz, 703-803-4904 Contract Administrator and Phone No.: The Invention First Constructed While Charging Time to Job No.: And Working On: Title: Government Contract or Subcontract No.: Title: TRW Funded (IR&D, B&P, PM&P) Project No.: / Customer: Commercial Contract No.: Other, Explanation: Contract Administrator and Phone No.: Tom Kerr: Contract or Project Information (Must be Completed) 99X637 The Invention First Conceived While Charging Time to Job No.:

And Working On: DoD PKI Marketing (OITE)

Government Contract or Subcontract No.:

Title:

(Obtain All Signatures Before Sending to Patent Counsel)

Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read and Unde	erstood by:	Witness:	Date:	Supervisor:	Date:

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	Commercial Contract No.:			tomer:	l and	
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	Contract Administrator and					
Th	ne Invention First Constructe	ed While Cha	arging Time to Job No.:		<del></del>	
Ar	nd Working On:		•			
	Government Contract or S	Subcontract	No.:	Title:		<u> </u>
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Te	ii Us All About Your Inven	tion:	,			
٧	Vhat was the <u>problem</u> or <u>n</u>	eed that yo	u were trying to solve?			
t i	nember of the enterprise nust use a specific "trust degree of specialized known in process opens up the Tokenizing Officer. This trug to later repudiation intensive way of issuing certificates stored on a	sted" work nowledge he token as possibility of certific g tokens w	pertaining to PKI tec assignment process to y endangers the integrate use by a user. The	nnology. In ac nology. In ac prity of an ent ne problem is	ddition to being la mpering and mist erprise PKI syste to establish a les	abor-intensive, takes by the em, and opens as labor-
· · · · · · · · · · · · · · · · · · ·	Inventive Concept – What The concept allows a T basic interface, such as in assigning a token to associated public certifitoken. It binds the cert Directory/database. It sof user signature certificate Management package so as to present token that has bee Obtain All Signatures Before	okenizing a web para a user. It icate with diffed toker istores a resident System erve the variassigner.	Officer to access ce age. It uses an enter uses the existence of the organization's Din ID number to a cert ecord of Tokenizing Cenerates the user's si and wraps the private alidity of non-repudiant of particular user.	rtificate assig prise Director of the Token I rectory/Datab ified user ID officer's signa gning key and e key/certification. The pul	D (such as a seriouse as proof of a sumber within an ture in correlation d certificate in the ate in a signed arblic key used must be of a sumber of a	ial number) and an eligible organization's with creation e central and encrypted st be the key of bordinate
_			Inventor:	Date:	Inventor:	Date:
	Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
	Witnessed, Read and Unde	rstood by:	Witness:	Date:	Supervisor:	Date:
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ertificate Authority traceal to the Root Public Certificate. It the ransmits the user's ertificate/private key to the Tokenizing Officer encrypted for use only by the designated token. The ystem then delivers (stores) the encrypted package to the user's token. The token is the only ntity capable of decrypting the certificate/private key. The token validates the signature of the ackage, unwraps the key and certificate, and stores them so that they are accessible via CAPI or KCS#11 calls.

Proof of possession is obtained by requiring an initial digital signature. At that point, the certificate stagged as being activated by publishing of the certificate within the directory.

nvention Description and Operation: (Attach Drawings Or Sketches for Each Embodiment)

A User presents credentials to the Tokenizing Officer, who enters user's ID number, organization, and token ID number into E-form Request web page. The E-form Request is sent to Certificate Management System (CMS), which checks for existing tokens for the user and revokes the certificates contained on the token. The CMS then identifies user's organization and loads an organization-specific E-form. The CMS auto-fills the E-form with data from the user's organization's directory/database and returns the auto-filled E-form to Tokenizing Officer. The Tokenizing Officer compares form data with the user credentials. The tokenizing officer electronically signs the form, and submits it back to the CMS. The CMS facility receives the form and validates the Tokenizing Officer's signature against the certificate recorded by Certificate Authority. Certificate Authority generates the user's key and signing certificate and wraps (encrypts) it using the specified token's public key. This data package is then transmitted to the Tokenizing Officer's workstation, where the Tokenizing Officer stores the data package on the token. The encrypted package contains the user's private key and public certificate. Finally, Tokenizing officer issues token to user. The Tokenizing officer retains a copy of the personally signed form in which the user accepts the token, and all its responsibilities. This meets the requirement for a traceable wet signature to any digital signature, as well as requirements for a "face-to-face", required by most high-trust CMS systems.

Finally, the user must digitally sign the E-Form for final submission to the CMS system. This signature provides proof of acceptance. Upon receiving proof of acceptance, the certificate is published in the directory by the CMS system. A compatible On-Line Certificate Status Protocol (OCSP) responder will then reply to any validation request that the certificate is now valid. The OCSP will reply with a valid response to any certificate which has been published in the directory, and which is not in the Certificate Revocation List (CRL). The OCSP will reply unknown if the CRL is not available, or current, or if the certificate is not published. The OCSP will respond invalid if the CRL indicates that the Certificate for the user has been revoked.

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btain All Signatu	ires Before Sending	g to Patent Counsel)	Detai	Inventor:	Date:
entor:	Date:	Inventor:	Date:	inventor.	
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entor:	Date:	Inventor:	Date:	inventor.	
				Supervisor:	Date:
itnessed Read	and Understood by	: Witness:	Date:	Supervisor.	



### hat are the advantages to your invention?

ne Tokenizing Officer in this system requires no PKI-specific training, but rather needs only to be ble to operate a web page like interface. This Tokenizing system transmits the user's signing entificate to the Tokenizing Officer in a form that only the user's designated token can decrypt, ecuring it from tampering. The Tokenizing Officer's electronic signature is archived to provide an adit trail in the event of signature repudiation questions or issues. These measures decrease the set for training of Tokenizing personnel, and increase the integrity of the user's signing certificate.

### vernment, industrial or commercial applications:

What are the current plans, if any, for the concepts discussed in the Invention Disclosure? If none, please so state.

This concept will be suggested to other commercial and government customers as part of TRW marketing activities associated with PKI or other digital signature technologies.

Is there an intended TRW commercial product that will use the concepts in this Invention Disclosure?

There is a "product" in the sense that S&ITG will offer at a pre-defined price with a pre-defined schedule a PKI "solution" to both commercial and government customers. That product is still being defined. Multiple divisions are participating in the definition of the product.

### If Yes, what is the intended commercial product?

The product is an "e-business" solution that provides digital signatures and paperless workflow to an enterprise.

If Yes, when will the intended commercial product be developed?

Is there an intended TRW generic use for the concepts in this Invention Disclosure?

If Yes, what is the intended generic use?

btain All Signatures Before Sending to Patent Counsel)					
/entor:	Date:	Inventor:	Date:	Inventor.	Date:
ventor:	Date:	Inventor:	Date:	Inventor:	Date:
itnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:

Supplemental One Sheet Description - In Viewgraph Format, Tell Us About Your Invention To be Used at Invention Evaluation Committee Meeting)

Title: PKI Token Issuance and Binding Process

Summary of Idea:

The process of using a secure electronic system to allow an authorized individual (Tokenizing Officer) within an enterprise to assign a token to a user while eliminating the possibility for compromise of the token generation process.

### Nhat Do You Believe is the Innovative Concept:

The innovative concept is that Tokenizing officer functions are reduced to the bare minimum, validating the identity of a user of the system by the comparison of database information with presented credentials. The process of recording a correlation between a token, a user, and all sertificates stored on a token is "User ID Binding". This process is initiated when the Tokenizing Officer assigns a token to an entity. Once the entity and the token are bound together in the directory, any certificates (identity or role) that are established on the token (via encrypted lownload using the Primary Token Identity Certificate) are also bound to the entity. The Certificate subject name (in the directory tree) is designed to bind the identity or role of the user, the identity of he token, and any and all future PKI certificates together.

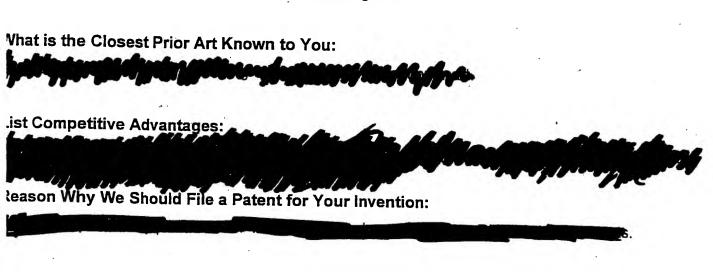


EXHIBIT D

Call up 1st don't =

Law Department

One Space Park Redondo Beach, CA 90278 310.812.4321 E2/6051 310.812.1534 Telecopier 310.812.2687 E-mail: loma.schott@trw.com

April 5, 2001

Donald E. Stout, Esq. Antonelli, Terry, Stout & Kraus, LLP Suite 1800 1300 North Seventeenth Street Arlington, Virginia 22209

Subject: TRW Docket No. 15-0251

Last Day to File Application:

Gov't. Contract No.: Restricted

Billing Unit: SITG/IIT-DSO - Billing Code: 312

TRW Docket No. 15-0252

Last Day to File Application:

Gov't. Contract No.: N/A

Billing Unit: SITG/IIT-DSO - Billing Code: 312. 199.40006XDE

TRW Docket No. 15-0254

Last Day to File Application

Gov't. Contract No.: N/A Billing Unit: SITG/IS - Billing Code: 312

TRW Docket No. 15-0255

Last Day to File Application:

Gov't. Contract No.: N/A Billing Unit: SITG/IS - Billing Code: 312

TRW Docket No. 15-0256

Last Day to File Application: Gov't. Contract No.: N/A

Billing Unit: SITG/IS - Billing Code: 312

Dear Don:

Enclosed herewith are copies of the above-referenced invention disclosures. No formal patentability searches will be conducted in these matters.

Donald E. Stout, Esq. April 5, 2001 Page 2

The first draft applications should be submitted to this office no later than **Carlot Statutory**. All cases have potential statutory bar dates. TRW Dockets No. 15-0254, 15-0255, and 15-0256 should be filed on the same day. Please follow the new format for preparing the patent applications based on the new Rules and Regulations (see Federal Register/Vol. 65, No. 175/Friday, 9/8/00). The draft applications and drawings should be sent by regular U.S. mail, along with a copy of each on disk.

You should also be aware that all transmittals of drafts and comments should be directed to this office, and not directly between you and the inventor, so that I can keep track of the progress of the preparation. If you need to deviate from any of the above procedures, please contact me immediately.

Attached is a list of standards that we are now requiring for all patent application preparation. Please follow these guidelines.

The transmittal should indicate whether or not there are any statutory bars running of which you are aware, and whether or not there are any impediments to our filing corresponding foreign applications. Your firm is also responsible for informing us if there are any related and/or co-pending applications that are to be filed at the same time.

So that there is no question as to division of responsibilities, this office will be responsible for the preparation of the formal papers (declaration, power of attorney, assignment) and the actual filing of the applications.

I look forward to working with you to obtain the best patent coverage we can for these inventione. If you have any questions concerning these matters, please do not hesitate to contact me.

Lorna L. Schott

Patent Administrator

/lls

**Enclosures** 

### PATENT APPLICATION PREPARATION STANDARDS

- The first page of the application should include: Title, Headings for Cross-reference and/or Government clauses, only when applicable (leave out if not applicable), followed by Background, Summary of Invention, etc. Do not include a separate Cover/Title page,
- The header should contain the TRW Docket Number in the upper right hand corner, as well as the Express Mail, mailing language,
- Standard government contract clause (Restricted or Unrestricted) inserted upon first draft, when applicable,
- Specification with claims,
- Drawings prepared in semi-formal format (no shading see Guide for the Preparation of Patent Drawings - Dept. of Commerce),
- Information Disclosure Statement and Form PTO-1449 signed by you,
- Abstract (no longer than 150 words, not including the title) with reference numerals suitable for filing in foreign jurisdictions,
- Title of patent application on the abstract,
- Draft application on 8 1/2" x 11" bond paper (Please follow the new format as stated in the Rules and Regulations - Federal Register/Vol. 65, No. 175),
- Copy of the application (initial drafts and subsequent drafts) on diskette readable by Microsoft Word running on a P.C. enclosed in a protective cover.
- The transmittal should also indicate whether or not there are: any related cases, statutory bars running of which you are aware, and whether or not there are any impediments to our filing corresponding foreign applications.
- All interviews with inventors should be cleared through this office. Any subsequent interviews, correspondence, or document exchange between you and the inventor should also be directed through this office, as well as copies of all documentation sent to us.

EXHIBIT E

### Henry Zykorie

From:

Henry Zykorie

Sent:

Wednesday, April 11, 2001 10:01 AM

To:

'ken.aull@TRW.com'; 'tom.kerr@TRW.com'

Cc:

'Lorna.schott@TRW.com'

Subject:

TRW Docket #15-0254; Our Docket #199.40006 x00

Importance:

High

### Good morning:

My name is Henry Zykorie, and I am a patent attorney of the Washington, D.C.area law firm of Antonelli, Terry, Stout & Kraus, LLP. Our law firm has been assigned to draft/file a patent application for one of your recent TRW invention disclosures as identified above.

I would like to arrange a telephone interview with both of you in order to prepare the application. Accordingly, please tell me when will be the best time for me to call you directly to discuss about the application. Also, the following items are very helpful in facilitating discussions of the invention and/or teaching us about the technology to which the invention is related:

- 1) Any prior art articles and/or relevant technical publications relating the general state of the art that you might have considered during conception and preparation of your Invention Disclosure, or of which you are aware including a copy of the PowerPoint publication cited in the Invention Disclosure;
- and 2) A copy of drawings, sketches and/or any text of the invention that you might have prepared for the Invention Disclosure on a floppy disk (this can be helpful for us to prepare informal drawings of the patent application for filing in the U.S. Patent & Trademark office).

Further, it is recommended that you facsimile (fax703/312-6666) or mail such materials to us in advance of any telephone conference, as it is helpful if we can both access and discuss similar materials during the telephone conference.

I would like to start working on the patent application as quickly as possible, so your promptness to confirm the above schedule would be greatly appreciated. I look forward to working with you on this patent application.

Best regards,

Henry
Henry M. Zykorie
Antonelli, Terry, Stout & Kraus LLP
1300 North Seventeenth Street
Suite 1800
Arlington, Virginia 22209
(tel) 703 312-6634
(fax) 703 312-6666
e-mail: hzykorie@antonelli.com

EXHIBIT F

### Henry Zykorie

From: Sent:

Tom Kerr [Tom.Kerr@trw.com] Thursday, May 03, 2001 8:09 AM

To:

Henry Zykorie 'Ken Aull'; 'Lorna.schott@TRW.com'

Cc: Subject:

Re: TRW Docket #15-0254; Our Docket #199.40006 x00



Ken and I are done with the proposal that we have worked for the past 8 Schemes.ppt weeks.

I'm attaching the Powerpoint presentation cited in the invention disclosure.

Will forward additional documents and drawings that we prepared earlier for

these dockets.

Unfortunately, the company has taken 4 related PKI dockets and given them out to four different persons to finalize the patent applications. FYI - there previous PKI patent applications filed last year by TRW - upon which this builds.

Give us a call any time when you return to the office.

Tom Kerr TRW Systems 1 Federal System Park Drive Mail Stop: FP1/4165 Fairfax, VA 22033

703-803-5618

Henry Zykorie wrote:

> Hi again-

> Just a reminder that I had yet to receive a response to my April 11, 2001

> e-mail noted below.

> I await your response noting that I will be out of the office from

Accordingly, please reply

as soon

Thursday,

> as possible!

> Regards,

> Henry

> Henry M. Zykorie

> Antonelli, Terry, Stout & Kraus LLP

> 1300 North Seventeenth Street

> Suite 1800

> Arlington, Virginia 22209

> (tel) 703 312-6634

> (fax) 703 312-6666

> e-mail: hzykorie@antonelli.com

EXHIBIT G LAW OFFICES

ANTONELLI, TERRY, STOUT & KRAUS, LLP

**SUITE 1800** 

1300 NORTH SEVENTEENTH STREET ARLINGTON, VIRGINIA 22209

June 22, 2001

OF COUNSEL
HENRY M. ZYKORIE\*
ROBERT F. GNUSE

PATENT AGENT LARRY N. ANAGNOS

TELEPHONE (703) 312-6600 FACSIMILE (703) 312-6666

WRITER'S DIRECT EMAIL hzykorie@antonelli.com

RANDALL S. SVIHLA HUNG H. BUI\* GEORGE N. STEVENS\* FREDERICK D. BAILEY DAVID C. OREN RALPH T. WEBB\*

DONALD R. ANTONELLI

WILLIAM I. SOLOMON"

RONALD J. SHORE

DONALD E STOUT

ALAN E. SCHIAVELLI JAMES N. DRESSER

CARL I. BRUNDIDGE

ROBERT M. BAUER

PAUL J. SKWIERAWSKI\*

GREGORY E. MONTONE

DAVID T. TERRY MELVIN KRAUS

\*ADMITTED OTHER THAN VA

Lorna L. Schott Patent Administrator TRW Inc. One Space Park Redondo Beach, CA 90278

Re: DRAFT APPLICATION of TRW-150254

Dear Lorna:

We have completed the preparation of the above-identified application and enclose a paper copy of the application and drawings as well as a disc containing the application. Please advise if you need in changes made to the application. We have forwarded this via Federal Express but have not billed you for those charges.

Very truly yours,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

Henry M. Zykorie

HMZ:dmw

EXHIBIT H

Law Department

TRW inc.

One Space Park Redondo Beach, CA 90278 Direct Dial No. 310.812,1534 Telecopier 310.812.2687 Building E2/6051

October 18, 2001

Henry M. Zykorie, Esq. Antonelli, Terry, Stout & Kraus, LLP 1300 North Seventeenth Street, Ste. 1800 Arlington, VA 22209

Subject:

TRW Docket No. 15-0254; Your File No. 199.40006X00

Title: PUBLIC KEY INFRASTRUCTURE TOKEN ISSUANCE

AND BINDING

√ Dear Henry:

Enclosed please find the inventor's first review comments in connection with the above-referenced application. TRW will prepare the formal incomprate these changes and return the revised application to me drawings. Please note there is a and include an electronic version on disk in Word 6.0 for the PC.

For your convenience, I have also enclosed the disk submitted with the original draft application.

Thank you for your attention in this matter.

Sincerely,

Lorna L. Schott

Patent Administrator

/mlb

Enclosures

EXHIBIT I LAW OFFICES

### ANTONELLI, TERRY, STOUT & KRAUS, LLP

SUITE 1800

1300 NORTH SEVENTEENTH STREET ARLINGTON, VIRGINIA 22209 October 26, 2001 OF COUNSEL DAVID T. TERRY HENRY M. ZYKORIE\* ROBERT F. GNUSE HAROLD A. WILLIAMSON\*

> PATENT AGENT LARRY N. ANAGNOS

> > TELEPHONE (703) 312-6600 FACSIMILE (703) 312-6666

EMAIL email@antonelli.com

RANDALL S. SVIHLA HUNG H. BUI\* GEORGE N. STEVENS\* FREDERICK D. BAILEY DAVID C. OREN RALPH T. WEBB\*

ONALD R. ANTONELLI

ILLIAM I. SOLOMON'

ONALD E. STOUT

LAN E. SCHIAVELLI

IAMES N. DRESSER

ARL I. BRUNDIDGE

PAUL J. SKWIERAWSKI\* ROBERT M. BAUER

REGORY E. MONTONE ONALD J. SHORE

ELVIN KRAUS

ADMITTED OTHER THAN VA

Lorna L. Schott
Patent Administrator
TRW Inc.
One Space Park
Redondo Beach, CA 90278

Re: TRW Docket No. 15-0254 – Our File No. 199.40006X00 Title: PUBLIC KEY INFRASTRUCTURE TOKEN ISSUANCE AND BINDING

Dear Lorna:

Thank you for your letter of October 18, 2001. We have made the requested revisions to the application and enclose the same as a paper copy as well as on disc.

Please advise if you have any further questions in connection with this application.

Very truly yours,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By:\_\_\_\_\_ Henry M. Zykorie

HMZ:dmw Enclosures

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